REMARKS

Claims 17-36 remain in this application. Claims 1-16 have been canceled. Claims 23-29 and 34 stand withdrawn from consideration.

The examiner's indication of allowable subject matter in claims 20 and 21 is appreciated. Claims 20 and 21 have been rewritten in independent form including all of the limitations of the base claim and any intervening claims and are now in allowable condition.

It is noted that claims 35 and 36 were rejected for the first time in the final rejection under 35 U.S.C. 103 as unpatentable over Claxton in view of Takenaka et al and that the rejection was **not** necessitated by the previous amendment. The only amendment made to claims 35 and 36 in the previous amendment was the deletion of the word "the." In other words, the rejection of claims 35 and 36 under 35 U.S.C. 103 as unpatentable over Claxton in view of Takenaka could have been made in the first Office action on the merits, but was not. Thus, the finality of the rejection was premature. Accordingly, the examiner is requested to withdraw the finality of the last Office action.

Claims 17-19, 22, 30-33, 35 and 36 have been rejected under 35 U.S.C. 103(a) as unpatentable over Claxton et al. (US 4,417,694) in view of Takenaka et al. (US 4,509,803). Reconsideration of the rejection is required.

In the rejection, the examiner cites Claxton et al for a teaching of the basic fuel injection valve structure recited in claim 17, without the microscope indentations on the valve sealing face and/or the valve seat as additional recited in claim 17.

Takenaka et al is cited for a teaching of "microscopic etchings for use on sliding members, specifically for use on a valve guide (or member) as well as a mechanical seal (Col. 5, lines 14-23)" (Final Rejection, page 3).

At col. 5, lines 14-23, Takenaka et al actually teaches:

> A sliding member according to the present invention can be used as a member of a rotary compressor, a swash plate-type compressor, a thrust washer, a slide bearing, a valve guide, a floating- or semi-floating-type bearing of a supercharger, a mechanical seal of a supercharger or rotary pump, and the like. The advantages attained when a sliding member according to the present invention is used as a member of a rotary compressor, a swash plate-type compressor, or a mechanical seal are hereinafter described.

The word "valve" is not found elsewhere in Takenaka et al's specification or claims. As to the words "mechanical seal," Takenaka et al explains at col. 6, lines 15-31, that:

> A mechanical seal is used for providing a gas- or liquid-proof shaft assembly. Usually, a member made of graphite and a member made of carbon steel are assembled to manufacture a mechanical seal in which both members are pressed against and slide relative to each other at a high surface pressure and one of the members is rotated relative to the other member. The above-described mechanical seal is neither highly gas- or liquid-proof nor highly resistant to seizure if the members are conventionally surface-finished. When one of both of the above members have micropores according to the present invention, the gas- or liquid-proofness is enhanced, presumably because the surface-shape of the above members having micropores remains unchanged

and the lubricating oil is retained in the micropores. In addition, the seizure resistance and the friction characteristics are considerably enhanced.

It is clear from a proper understanding of the teachings found at col. 6, lines 15-31, that the "mechanical seal" referred to in Takenaka et al is actually a seal formed at the contact surfaces of a stationary member and a rotating or sliding shaft.

Based on the teachings in Takenaka et al, the examiner concludes that it would have been obvious to have modified Claxton et al's fuel injection valve structure with the microscopic etching of Takenaka et al in order to improve sealing on the valve member as well as provide lubrication to the fuel injection valve. See, Final Rejection, page 3.

It is believed that the combination of references applied by the examiner in his prior art rejection does not teach or suggest the claimed invention for at least the following four reasons:

1. The Takenaka et al disclosure is directed towards sliding seals such as found in rotary devices, valve guides and bearings as described by Takenaka et al at col. 5, lines 14-19. These devices have different structures and motion characteristics than a fuel injection valve. Particular attention should be noted of the location of the microscopic indentations recited in claim 17. Claim 17 requires that the microscope indentations be provided on the valve sealing face and/or the valve seat of the fuel injection valve. Thus, in applicants' invention, the microscopic indentations are part of the seal that is formed to keep fuel which is under pressure in chamber 19 from escaping through openings 11 when the valve needle is

in its closed, or in a sealed position. When in the closed position, there is absolutely no movement between applicants' structure, seat 9 and valve needle surface 7. When in the closed position, these surfaces are forced together by the closing force of the injection valve as mentioned in paragraph 4 and elsewhere in the specification. The shape of conical seat 9 and substantially mating conical surface 7, plus the force with which they are moved together and held closed, do not permit for any relative movement between these surfaces once the valve is closed.

In contrast to this, in Takenaka et al, in every one of the listed environments, see Takenaka et al at column 1 line 8, column 4 line 53, and column 5 lines 14-23, the micropores are used to help lubricate parts which are continuously moving with respect to each other. In Takenaka et al the micropores are never used to help close a valve structure.

As taught in applicants' specification:

[t]he valve seat and the valve sealing face are embodied as at least substantially conical. Because of the short opening times of the fuel injection valve, the valve needle must be moved with very great forces, if suitably short switching times are to be attained. The valve needle therefore attains high speeds, with which, with its valve sealing face, it **strikes** the valve seat in the closing motion. (spec., para. 3, emphasis added)

and

[s]trong forces and hence high accelerations therefore act on the valve needle 5 and cause the valve needle 5 to **strike** the valve seat 9 at high speed; in operation of the fuel injection valve, the sealing edge 30 is **hammered** into the valve seat 9 somewhat as a result, resulting in an adaptation between the valve sealing face 7 and the valve seat 9. (spec., para. 22, emphasis added)

The force of a fuel injection valve needle striking a valve seat is akin to a hammer striking an anvil. It is more an impact force than a friction force. Thus, the problem with

which Takenaka et al is concerned, one of reducing the wear of two surfaces as a result of sliding friction, is different from the problem solved by applicant's invention, namely, reducing wear of two surfaces as a result of the impact of the injection valve needle striking the valve seat.

Thus, the teachings found in Takenaka et al are not from the same environment as applicants' structure and relate to an entirely different problem. Accordingly, there is no reason why one skilled in the art would have looked to the teachings in Takenaka et al to find a solution to the problem confronting the applicants.

Moreover, as pointed out in applicants' disclosure, avoiding wear of the valve sealing surfaces, and thus maintaining constant characteristics for the closing properties of the injection valve, see paragraphs 3, 4, 5 and 7 of the specification, is critical to obtaining a longer life of the fuel injection valve. This maintains the same injection characteristics for each injection event of the fuel injection valve, a property which is critical in obtaining continued service life and constant fuel injection properties for the fuel injection valve. There is nothing in Takenaka et al suggesting that the properties of the sealing faces of a any valve, much less of a fuel injection valve, would be improved by the addition of microscope indentations on the valve sealing face and/or the valve seat of a valve.

2. The structure of Takenaka et al is directed towards devices which are lubricated with lubricating oil, see col. 7, lines 8-9 and col. 8, lines 46. This point again makes the structure of Takenaka et al entirely different from applicants' fuel injection valve. Applicants' injection valve relies on, and the only lubrication is from, the fuel itself, a liquid which has entirely different properties than does any lubricating oil. There is simply no way

that lubricating oil could be maintained in applicant's microscopic indentations. Being part of a fuel injection valve, the fuel would quickly wash any such lubricating oil from the microscopic indentations.

3. The micropores in Takenaka et al are formed differently from the indentations in the application. None of the production methods recited in claim 33 are disclosed by Takenaka et al. Being made by different processes, the micropores in Takenaka et al would thus have structure which is different from the structure of the microscopic indentations generated by the methods recited in applicants' claim 33.

4. In col. 9, lines 4-7, Takenaka et al state that long scratches do not fall within the claimed definition of their micropores. Applicants' use of grooves as one species highlights the difference between the structure, purpose and use of applicants' microscopic indentations in a fuel injection valve and the micropores of Takenaka et al which are used in sliding applications as opposed to applicants' application in which there is no sliding of the needle 5 and its surface 7 with respect to the seat 9.

Accordingly, claim 17 and its dependent claims are not rendered obvious by the combined teachings of Claxton et al. and Takenaka et al.

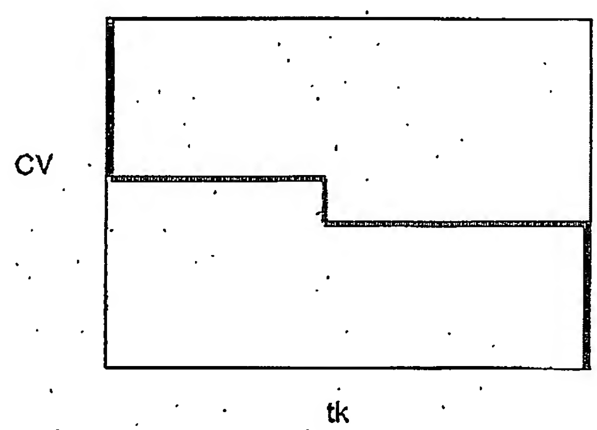
Still further, attention is directed to the language of claims 18 and 19. Claim 18 is dependent on claim 17 and further requires that the microscopic indentations are embodied individually and are separate from one another. Claim 19 is dependent on claim 18 and further requires that the microscopic indentations are embodied as dimples.

Takenaka et al lacks any disclosure of dimples that are all of the same kind and that are clearly separated from one another. In Takenaka, a surface with a given roughness is

proposed as illustrated in Fig. 1A. As one can see, there are no separated dimples, but a general roughness resembling a wave pattern.

The analysis of this pattern is given in Fig. 1B: Defining level A1 as the highest level of a ridge and A2 … A14 levels spaced from A1 by a given distance; the valves t_k are calculated by the sum of all cutting lengths in relation to the total arbitrary length L; thus, t_1 is 0%, since the line A1-A'1 cuts the surface at no point, and t_{14} is 100%, since the line A14-A'14 cuts through the surface at the whole length L.

In Fig. 1A, the example of A5-A'5 is shown. The line A5-A'5 cuts through the surface at the lengths l_1, l_2, and l_3, resulting in about t_5 = 35% when the sum of l_1, l_2, and l_3 is divided by L. Plotting the valve of t_k in relation to the depth CV of the respective level A … A' gives the curve in Fig. 1B, which clearly shows that there are no separated dimples. Otherwise, the curve in Fig. 1B should look like this:



In Takenaka et al, there is a distribution of micropores of different depths and diameters and no separate dimples. For, these additional reasons, claims 18 and 19 are not rendered obvious in view of the combined teachings of Claxton et al. and Takenaka et al.

Please charge the fee for any necessary extension of time to deposit account No. 07-2100.

Entry of the amendment, withdrawal of the finality of the last Office action and allowance of the claims are courteously solicited.

Respectfully submitted,

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